IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

SIMMELINK et al Atty. Ref.: **4662-205**

Serial No. **10/584,235** Group: **1791**

Filed: **September 8, 2006** Examiner: **HINDENLANG**

For: **PROCESS FOR MAKING HIGH-PERFORMANCE POLYETHYLENE MULTIFILAMENT YARN**

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July 8, 2011

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPLICANTS' BRIEF ON APPEAL

Sir:

This Appeal is from the Official Action dated November 8, 2010, twice rejecting claims 1-2, 4-8 and 10-15, all of the claims presently pending herein.[1] As will become evident from the following discussion, the Examiner's rejection is in error and, as such, reversal of the same is solicited.

[1] The claims pending in this application and on appeal herein appear in the Section VIII Claims Appendix accompanying this Brief.

I. Real Party In Interest

The real party in interest is the owner of the subject application, namely DSM IP Assets, BV.

II. Related Appeals and Interferences

No appeals and/or interferences related to this application are known to be pending.

III. Status of Claims

A. The following claims are presently pending in this application: Claims 1-2, 4-8 and 10-15.

B. The following claims are the claims on appeal and have been twice rejected by the Examiner's Official Action of November 8, 2010: Claims 1-2, 4-8 and 10-15.

C. The following claims have been cancelled during prosecution to date: Claims 3 and 9

D. The following claims have been allowed: None

E. The following claims have been withdrawn: None

F. The following claims have been objected to: None

IV. Status of Amendments

No amendments subsequent to the Official Action dated November 8, 2011 have been submitted.

V. Summary of Claimed Subject Matter[2]

The invention as defined by pending independent claim 1 relates to a process for making high-performance polyethylene multifilament yarn (page 1, lines 6-7) comprising the steps of:

a) making a solution of ultra-high molar mass polyethylene (UHPE) in a solvent (page 1, line 8), wherein the UHPE has an intrinsic viscosity of between 5 and 40 dl/g (page 6, lines 19-21);

b) spinning of the solution through a spinplate containing a plurality of spinholes into an air-gap to form fluid filaments, while applying a draw ratio DR_{fluid} of at least 50 (page 1, lines 9-10 and page 6, lines 8-9), wherein $DR_{fluid} = DR_{sp} \times DR_{ag}$, where DR_{sp} is the draw ratio in the spinholes and DR_{ag} is the draw ratio in the air-gap, with DR_{sp} being greater than 1 and DR_{ag} being at least 1 (page 2, line 33 through page 3, line 2 and original claim 1);

c) cooling the fluid filaments to form solvent-containing gel filaments (page 1, line 11);

d) removing at least partly the solvent from the filaments (page 1, line 12); and

e) drawing the filaments in at least one step before, during and/or after said solvent removing, while applying a draw ratio DR_{solid} of at least 4 (page 1, lines 13-14 and page 8, line 14), wherein

each of the spinholes has a geometry comprising a contraction zone having a gradual decrease in diameter from a diameter D_0 to a diameter D_n and a cone angle in the range 8-75°, (page 3, line 32-35) and wherein

[2] The numbers in parenthesis refer to page and line numbers of the originally filed specification which provide representative descriptive support for the claimed subject matter.

each of the spinholes further comprises an inflow zone of constant diameter of at least D_0 and a length L_0, with a length/diameter ratio L_0/D_0 of at least 5 (Page 5, lines 9-11), and wherein

each of the spinholes comprises a zone downstream of the contraction zone having a constant diameter D_n of from 0.3 to 5 mm and a length L_n with a length/diameter ratio L_n / D_n of from 0 to at most 25 (page 3, line 35 through page 4, line 2 and (page 5, lines 4-5).

The invention as defined by pending independent claim 14 relates to a spinplate for spinning ultra-high molar mass polyethylene (UHPE) (page 8, line 35 through page 9, line1) having an intrinsic viscosity of between 5 and 40 dl/g (page 6, lines 19-21) comprising at least 10 spinholes (page 9, line 1) , wherein each spinhole has a geometry comprising an inflow zone of constant diameter of at least D_0 and a length of L_o and a length/diameter ratio L_0/D_0 of at least 5 (Page 5, lines 9-11), a downstream zone of constant diameter of at least D_n, wherein Dn is from 0.3 to 5 mm, a length L_n and a length/diameter ratio L_n/D_n of from 0 to 25 (page 3, line 35 through page 4, line 2 and (page 5, lines 4-5), and a contraction zone between the inflow and downstream zones having a gradual decrease in diameter from the diameter D_0 of the inflow zone to the diameter D_n of the downstream zone and a cone angle in the range 8-75° (page 3, line 32-35) .

VI. Grounds of Rejection to be Reviewed on Appeal

The following rejections to be reviewed on appeal were advanced in the Official Action dated November 8, 2010:

(1) "Claims 1, 2, 4-8 and 10-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kavesh (US 6448359) further in view of Chau (US 5296185) and optionally in view of Honnaker (US 4054468) (all of record)."

(2) "Claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chau (US 5296185) and optionally further in view of Honnaker (US 4054468 (both of record)."

VII. Arguments

1. Claims 1, 2, 4-8 and 10-13 Are Patentably Unobvious

(a) General Technology Background

What should not be overlooked when reviewing patentability is that the presently claimed invention relates to an improved process for spinning ultrahigh molar mass polyethylene (UHPE). UHPE is considered a "flexible chain" polymer, as opposed to "rigid chain" polymers such as aramids, e.g. poly(p-phenylene teraphthalamide) and polybenzazoles (e.g. polybenzoxales (PBO)).

A main difference between rigid and flexible chains is the necessity of chain extension (or orientation) in the case of flexible polymer molecules in order to exploit the intrinsic properties of the chain. For rigid chain polymers generally the chains orient in an extended chain formation during spinning, coagulation and heat setting. For flexible chain polymers, however, the chains tend to fold upon crystallization and orientation takes place upon drawing.

Specific routes have been developed to orient the folded-chain crystals into chain-extended structures. For the gel spinning process contemplated by the presently claimed invention this means that a further drawing step takes places after spinning the fibers, with a DR_{solid} of at least 4. This drawing step is necessary to obtain an extended chain formation, and thus ultimate strength.

The solution of UHPE used in the process of the claimed invention contains molecules with different chain lengths, i.e. it is a polymer with a molecular weight distribution. Without wishing to be bound by theory, it is believed that in a conventional process, the relatively long molecules cannot be oriented and that thus the higher strengths cannot be obtained.

With the process of the presently claimed invention, however, using the specific configuration of the spinhole having an inflow zone and a contraction zone, it is believed that the long chain molecules are oriented during their passage in these zones and stay this way in the final product. As can be seen in the examples of the originally filed specification, this results in a higher tensile strength when applying the same DR_{solid}.

(b) Unobviousness Over The Applied References

Kavesh discloses a method of preparing multi-filament yarns, comprising the steps of: extruding a solution of polyethylene and solvent through a multiorifice spinneret into a cross-flow gas stream to form a multi-filament fluid product, stretching the multifilament fluid product, quenching the fluid product in a quench bath to form a gel product, stretching the gel product, removing the solvent from the gel product to form a xerogel product and stretching the xerogel product.

Kavesh indicates that the draw ratio in and the dimension of the air-gap are critical parameters that determine properties of the filaments and yarn. No mention is made on controlling the draw ratio *in the spinholes*. The drawback of the Kavesh process is that small variations in air-gap draw ratio and dimension will result in process instabilities.

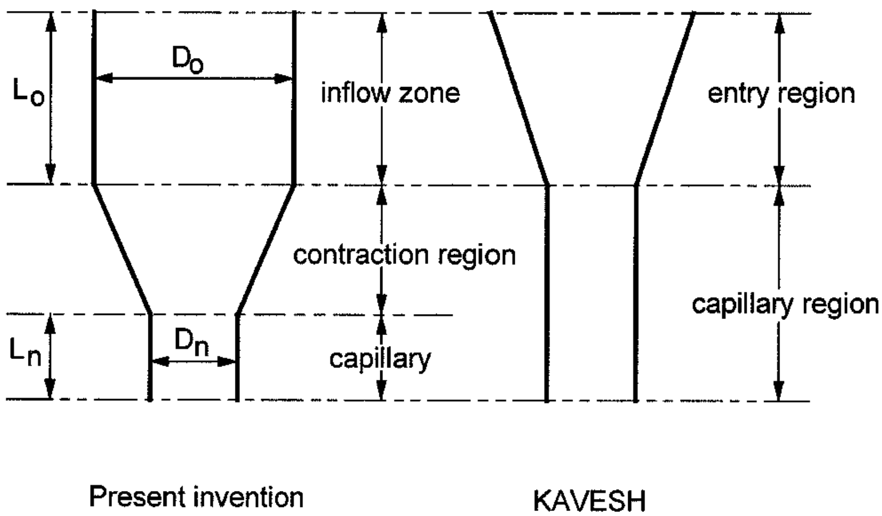
In contrast, the present invention employs a spin hole having a geometry comprising a contraction zone, with a gradual decrease in diameter from diameter D_0 to D_n with a cone angle in the range 8-75°. Such a spinhole geometer allows drawing to be achieved *in the spinhole*. Moreover, the draw ratio in the spinhole can be much better controlled as compared to the draw ratio of the drawing in air (i.e., as proposed by Kavesh). This better draw ratio control in turn allows for the fluid draw ratio DR_{fluid} to be better controlled as compared to drawing only in the air gap (i.e., as proposed by Kavesh).

Kavesh does not provide any hint at controlling DR_{fluid} by controlling the dimensional geometry of the spinhole. In addition, no spinhole is in fact disclosed in Kavesh having a contraction zone with a gradual decrease in diameter from diameter D_0 to D_n with a cone angle in the range 8-75°.

In this regard, the examiner's attention is drawn to Figure 2 of Kavesh and the text describing Figure 2 at column 4, lines 48-55 therein. As noted, the spinneret hole has a ***tapered entry region*** and a ***capillary region of constant cross section***. When the ordinarily skilled person reads an entry region, he would not understand it as the contraction zone as is defined in the applicants' pending claim 1. Instead, the ordinarily skilled person would understand that reference to an "entry region" mean a region for the spinning solution to enter the region from which the spinning solution is extruded, i.e. the capillary region downstream of the entry region.

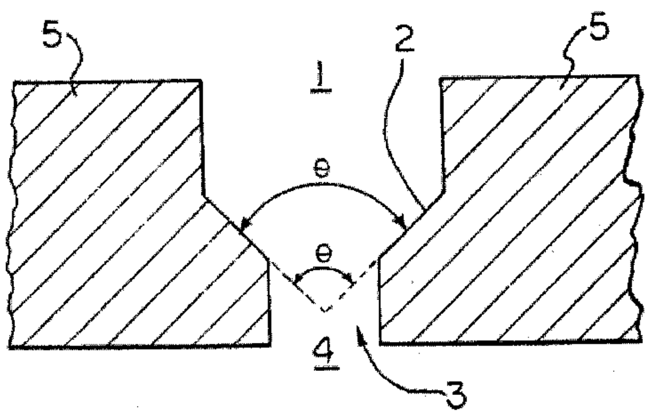
The entry region referred in Kavesh is only mentioned as "tapered". There is no teaching or suggestion for actually drawing of the UHMWPE in such region. This is further evidenced by the fact that there is no mention made of the angle of the taper, in contrast to the detailed description of the dimension of the capillary region. This really is not a surprise since, as noted above, an ordinarily skilled person would recognize that the actual region which extrudes the spinning solution is the capillary region, and not the entry region. From Kavesh, therefore, the ordinarily skilled person would not be taught to make a ***contraction zone for the purpose of drawing*** the UHMWPE as is defined in applicants' pending claim 1. Moreover, such a person would not therefore specifically choose the cone angle of the contraction zone to be within the range of 8-75°.

A drawing is shown below to further illustrate the structural differences between the presently claimed invention and Kavesh:



As is illustrated above, the spinplate of Kavesh does not have a contraction region as is defined in the pending claims herein -- it only has an entry region.

The Examiner apparently recognizes this deficiency in Kavesh as the secondary reference to Chau has been cited to allegedly show an inflow zone of diameter D_o. Chau discloses a spinneret having the following cross-sectional configuration:



And wherein the depicted structures consist of:

> (a) an inlet (1)
> (b) optionally, a transition cone(2) where the hole narrows by an angle (θ) before entry into a capillary section,
> (c) a capillary section (9), which is the thinnest (smallest-diameter) section of the hole where the walls are about parallel, and
> (d) an exit (4).
> The inlet may optionally have a counterbore, which may optionally be concave upward or concave downward or a fixed angle.

Applicants note that an ordinarily skilled person would not arrive at the presently claimed invention following a combination of Kavesh and Chau. The spinplate of Kavesh already has an inlet zone, and therefore the skilled person would not be prompted to further add an inlet zone. Furthermore, Kavesh is completely silent about the inlet except for the requirement that it has to be tapered.

The skilled person could not arbitrarily modify the inlet of Kavesh to also have the inlet (1) of Chau upstream of the inlet of Kavesh. If Chau is combined with Kavesh, the skilled person would have to replace the inlet of Kavesh with the inlet of Chau. This would result in a spinplate comprising an inlet having a constant diameter and a capillary region (which also has a constant diameter).

Moreover, the examiner alleges that Chau discloses inlet zones for the purpose of effectively transitioning to the capillary section. However, the passage in Chau referred by the examiner (column 5, lines 31-40) does not state that inlet zones are provided for the purpose of effectively transitioning to the capillary section. In fact, Chau is completely silent about the purpose of the inlet zones throughout the document.

Applicants likewise note that Chau discloses a ratio of Lo/Do which is <1 – ***not*** at least 5 as claimed herein. In this regard, while Chau does not disclose explicitly the dimension of the inlet, Fig. 1 of Chau does clearly shows that the diameter Do of the

inlet is larger than the length Lo of such inlet. In fact, the diameter Do of the inlet (1) of Chau appears to be about twice as large as the length Lo of the inlet (1). Therefore, even if Chau's inlet (1) were to be provided in the Kavesh spinneret, the presently claimed invention would not result.

Applicants also suggest that any "optimization" of Kavesh by the teaching of Chau would be done by an ordinarily skilled person with regard to the capillary dimensions and the entry angle (see column 6 of Chau). Chau is completely silent concerning the *length and dimensional ratio of the inflow zone*. As such, it cannot be considered to be routine skill to add these further parameters to combined disclosures, but supposes a level of creativity beyond that of the ordinarily skilled person. Nowhere does Chau indicate that an added inlet section upstream the contraction zone would or could stabilize the process of solution spinning.

The Examiner has asserted that Chau teaches a cone angle of the transition section of about 90° to less than about 20°. Applicants are however of the opinion that the disclosure by Chau will lead the person skilled in the art away from such cone angle. The process as described by Kavesh uses a dope at a throughput of 1 cm^3/min through a capillary of 40 mm length and 1 mm diameter. A contraction zone is absent in all examples. With this information the person of ordinary skill will be able to calculate the shear rate of the dope in the capillary by the formula proposed by Chau (column 6, line 31). Thus, a shear rate (γ) for the Kavesh process would be calculated to be about 170 sec^{-1}:

$\gamma = 8v_c / D_c$,

with $v_c = 1\ cm^3/min\ /\ (1000\ mm^3/cm^3\ /\ 60\ sec/min)\ /\ \pi.(0.5)^2\ mm^2 = 21.2$ mm/sec

and $D_c = 1$ mm.

From the teaching in Chau (column 6, lines 43-47), an ordinarily skilled person will learn that the cone angle may be about 180° (= no cone angle, no contraction zone) for dopes with a shear rate up to 500 sec^{-1}. The actual shear rate in Kavesh being well below that level (170 s^{-1} << 500 s^{-1}), the ordinarily skilled person is taught away from introducing a contraction zone, let alone experimenting with its cone angle in an attempt to optimize the spinning process. Following this path, s/he will not arrive at the presently claimed invention where the cone angle is in the range of between 8 to 75°.

It is clear therefore that there is no suggestion in Kavesh or Chau to modify the inlet of Kavesh in such a way that the inlet of Chau is added upstream of the inlet of Kavesh in order to achieve the presently claimed invention.

Kavesh is silent about the draw ratio $DR_{fluid} = DR_{sp} \times DR_{ag}$ being at least 50. The comparison of the experiments according to the present invention and the results of Kavesh as illustrated in Fig. 1 of the subject application, clearly shows the advantage of the present invention which is not suggested or even remotely taught by Kavesh.

In this regard, the Examiner will recall that the data in Fig. 1 of the subject application which replicates the Kavesh spinneret yielded a maximum value of DR_{fluid} of 33.8 – ***not*** a minimum of at least 50 as required by the pending claims herein. As described in the specification as originally filed on page 4, line 32 through page 5, line 2, the DR_{fluid} of Kavesh was presumed to be equal to DR_{ag} because the DR_{sp} is considered to be 1. The entry region of the spinneret in Kavesh is not the contraction zone that induces the DR_{sp}.

Therefore, one advantage of the present invention which is evident from the data of Fig. 1 in comparison with Kavesh is that improved processing stability and less filament breakage ensues which in turn results in yarns of more uniform and improved quality.

Chau also does not disclose a fluid draw ratio $DR_{fluid} = DR_{sp} \times DR_{ag}$ of at least 50. Nor would such a high DR_{fluid} be expected given the geometry of the inlet (1) as discussed above.

Moreover, applicants note that each reference relates to spinning of a <u>rigid</u> chain polymer, as will be shown in detail later. In such rigid chain polymers, orientation occurs during spinning, coagulation and heat setting. Thus, the ordinarily skilled person would be entirely cognizant that no further orientation through drawing is necessary.

Since the problem of having a fraction of long chain molecules does not occur with these types of rigid chain polymers, the ordinarily skilled person would not refer to such references. Moreover, the references only describe spinholes with a relatively small diameter. This fact is understandable given the process characteristics as described above.

Specifically Chau relates to the spinning of polybenzazole polymers, such as PBO and PBT. These are rigid chain polymers. It can also be seen that the process of Chau consists of spinning the dope, drawing the dope filaments across a draw zone and washing and drying the filaments and taking them up. No further drawing takes place. And as noted above, Chau does not provide information on the inflow zone having a length/diameter ratio of at least 5.

Thus, the pending claims herein are patentably *un*obvious over Kavesh alone or taken together with Chau. The optionally applied Honnaker publication does not cure the deficiencies noted above.

In this regard, Honnaker also describes a process for drawing a rigid chain polymer, specifically poly(p-phenylene teraphthalamide). The diameter of the spinhole in Honnaker is only 0.05-0.10 mm, which is substantially smaller than that according to the presently claimed invention. Calculating the length of the counterbore in Honnaker

using the numbers in column 4, lines 1 to 10 yields the result that the total thickness of the spinplate in Honnaker is at most about 9 mm.

Referring now to Example 1 of the subject application, it can be calculated that the spinplate of the invention has a total thickness of 58 mm! Thus, the spinplate of the present invention is totally different in size than that in Honnaker. Moreover, the dimensions could not be derived from Honnaker.

Applicants contend that the Examiner's assertion to combine the teaching of Chau and/or Honnaker to arrive at the L_0/D_0 ratio of at least 5 is in error for the reasons already discussed above. One of ordinary skill would simply not be capable of arriving at the presently invention starting from Kavesh and merely combining it with the teaching of Chau and/or Honnaker. Chau and Honnaker do not teach that the introduction and/or variation of an inflow zone are suited to optimize a process for making a high-performance polyethylene multifilament yarn.

It therefore follows that one of ordinary skill starting from the teaching of Kavesh and in view of Chau and Honnaker will likewise not arrive at the invention of pending claim 1 herein. The person skilled in the art will find no evidence in nor is it implied by the prior art that an inflow zone upstream of the contraction zone with an L_0/D_0 of at least 5 and a contraction zone with a cone angle in the range 8-75° are variations of spinholes beneficial to the spinning process of ultra-high molar mass polyethylene.

Therefore, Honnaker even if combined with Kavesh and Chau would not render the invention as defined by claims 1-2, 4-8 and 10-13 unpatentably obvious. Reversal of the rejection advanced against such claims under 35 USC §103(a) is therefore in order.

2. Claims 14-15 Are Patentably Unobvious

The discussion above with respect to the spinneret geometries is equally germane to the patentability of claims 14-15 over Chau and optionally in view of Honnaker.[3] Specifically, as was demonstrated above already, neither Chau alone or in combination with Honnaker provides a spinplate having the structural characteristics as defined by pending claims 14 and 15 herein.

The Examiner has asserted that Chau does not specifically teach a ratio L_0/D_0 of at least 5 but indicates that Chau teaches that "the size and geometry of the hole are preferably selected to maximize the stability of the dope flow through the hole". Applicants note in this regard that not only is Chau silent about an L_0/D_0 ratio but Chau also does not disclose an L_0 at all. Instead, Chau merely mentions the existence of an inflow zone. All specific spinholes in FIGS. 3A-3D of Chau have a disc-shaped inflow zone ($L_0 = 0$). As a consequence of this disclosure, one of ordinary skill would focus the spinhole optimization by varying the capillary dimensions and the entry angle as detailed by Chau throughout column 6. Purposely including two further spinhole characteristics <u>not</u> taught by Chau, namely the *<u>length and ratio of the inflow zone</u>*, can<u>not</u> be considered to be "routine skill" but instead involves a level of creativity beyond the one of an ordinary skilled person. Thus, contrary to the Examiner's assertions, an ordinarily skilled person would not arrive at the invention defined by pending claims 14-15 by mere "optimization" of the teaching of Chau.

The Examiner has also asserted that the person of ordinary skill would consider the combination of Chau and Honnaker to "optimize" the L_0/D_0 ratio. Though Honnaker discloses a counterbore with a preferred L/D ratio, Honnaker is silent about any effect

[3] The Examiner's statement on page 2, line 1 under the heading "DETAILED ACTION" appears to be a typographical error as claims 14 and 15 most certainly are claims directed to specifically defined structure -- not a process. It is understood in this regard, however, that the preamble expression in claims 14 and 15 with regard to the characteristics of the intrinsic viscosity of the ultra-high molar mass polyethylene has been given no patentable weight by the Examiner.

the counterbore or its L/D ratio could have on the spinning performance or the fiber properties. In contrast, Honnaker indicates that preferred tensile properties are obtained by adjusting size and dimensions of the spinning *capillaries*. The teaching of Honnaker with respect to the length of the counterbore is purely a result of the thickness of the backer-plate to prevent bulging of the spinneret face at high extrusion pressure. One of ordinary skill applying the teaching of Honnaker would thus not include a counterbore, let alone optimize the counterbore dimensions, when starting from the spinhole as disclosed by Chau.

As a consequence, the person ordinarily skilled in the art combining the disclosure by Chau with the teaching of Honnaker and employing his routine skills would thus not arrive at the invention as defined by pending claims 14-15 with its specific inflow zone and an optional capillary.

Reversal of the rejection of claims 14 and 15 under 35 USC §103(a) based on Chau and Honnaker is therefore in order.

3. Conclusion.

For the reasons advanced, the Examiner's rejections of the pending claims herein are in error and must be reversed. Such favorable action is solicited.

Respectfully submitted,

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VIII. CLAIMS APPENDIX

1. (previously presented) Process for making high-performance polyethylene multifilament yarn comprising the steps of:
   a) making a solution of ultra-high molar mass polyethylene (UHPE) in a solvent, wherein the UHPE has an intrinsic viscosity of between 5 and 40 dl/g;
   b) spinning of the solution through a spinplate containing a plurality of spinholes into an air-gap to form fluid filaments, while applying a draw ratio DR_{fluid} of at least 50, wherein $DR_{fluid} = DR_{sp} \times DR_{ag}$, where DR_{sp} is the draw ratio in the spinholes and DR_{ag} is the draw ratio in the air-gap, with DR_{sp} being greater than 1 and DR_{ag} being at least 1;
   c) cooling the fluid filaments to form solvent-containing gel filaments;
   d) removing at least partly the solvent from the filaments; and
   e) drawing the filaments in at least one step before, during and/or after said solvent removing, while applying a draw ratio DR_{solid} of at least 4, wherein

   each of the spinholes has a geometry comprising a contraction zone having a gradual decrease in diameter from a diameter D_0 to a diameter D_n and a cone angle in the range 8-75°, and wherein

   each of the spinholes further comprises an inflow zone of constant diameter of at least D_0 and a length L_0, with a length/diameter ratio L_0/D_0 of at least 5, and wherein

   each of the spinholes comprises a zone downstream of the contraction zone having a constant diameter D_n of from 0.3 to 5 mm and a length L_n with a length/diameter ratio L_n / D_n of from 0 to at most 25.

2. (original) Process according to claim 1, wherein the spinplate contains at least 100 spinholes.

3. (canceled)

4. (previously presented) Process according to claim 1, wherein the cone angle is from 10 to 60°.

5. (previously presented) Process according to claim 1, wherein the draw ratio in the spinholes is at least 5.

6. (original) Process according to claim 5, wherein the draw ratio in the spinholes is at least 10.

7. (previously presented) Process according to claim 3, wherein the length/diameter ratio L_n/D_n is at most 20.

8. (previously presented) Process according to claim 7, wherein the length/diameter ratio L_n/D_n is at most 15.

9. (canceled)

10. (previously presented) Process according to claim 1, wherein the length/diameter ratio L_0/D_0 is at least 10.

11. (previously presented) Process according to claim 1, wherein the spinplate comprises at least 10 cylindrical spinholes, and wherein each cylindrical spinhole includes an inflow zone of constant diameter D_0 and a length L_0 with a length/diameter ratio L_0/D_0 of at least 10, a downstream zone of constant diameter D_n and a length L_n with a length/diameter ratio L_n/D_n of at most 15, and a contraction zone between the inflow and downstream zones having a gradual decrease in diameter from the diameter D_0 to the diameter D_n with a cone angle in the range of 10-60°.

12. (previously presented) Process according to claim 1, wherein the fluid draw ratio DR_{fluid} applied to fluid filaments is at least 100.

13. (previously presented) Process according to claim 1, wherein step b) comprises spinning a 3-15 mass% solution of linear UHPE of IV 15-25 dl/g through a spinplate containing at least 10 spinholes into an air-gap, the spinholes comprising a contraction zone with a cone angle in the range 10-60° and comprising a zone downstream of the contract zone having a constant diameter D_n and a length L_n with a length/diameter ratio L_n/D_n smaller than 10, while applying a fluid draw ratio $DR_{fluid} = DR_{sp} \times DR_{ag}$ of at least 100 and a draw ratio DR_{solid} of between 10 and 30.

14. (previously presented) Spinplate for spinning ultra-high molar mass polyethylene (UHPE) having an intrinsic viscosity of between 5 and 40 dl/g comprising at least 10 spinholes, wherein each spinhole has a geometry comprising an inflow zone of constant diameter of at least D_0 and a length of L_o and a length/diameter ratio L_0/D_0 of at least 5, a downstream zone of constant diameter of at least D_n, wherein Dn is from 0.3 to 5 mm, a length L_n and a length/diameter ratio L_n/D_n of from 0 to 25, and a contraction zone between the inflow and downstream zones having a gradual decrease in diameter from the diameter D_0 of the inflow zone to the diameter D_n of the downstream zone and a cone angle in the range 8-75°.

15. (previously presented) Spinplate according to claim 14, comprising at least 100 spinholes.

IX. EVIDENCE APPENDIX

[NOT APPLICABLE]

X. RELATED PROCEEDINGS APPENDIX

[NOT APPLICABLE]

XI. CERTIFICATE OF SERVICE

[NOT APPLICABLE]